Quest Journals
Journal of Education, Arts, Law and Multidisplinary
Volume 16 ~ Issue 4 (Jul. – Aug. 2026) pp: 01-14
ISSN(Online): 2347-2895
www.questjournals.org

Research Paper

Managing the Ecological Crisis: Green Capitalism, Governmentality, and the Displacement of Environmental Harm

Amit Mishra[1], Himanshu Kumar Pandey[2], Shailendra Kumar[3], Prof. Sanjay Sonker[4]

Abstract

Contemporary sustainability strategies — net-zero accounting, green industrial policy, electric mobility are routinely framed as resolving the ecological crisis without structural transformation. Critical scholarship has examined sustainability as governance, accumulation, and risk redistribution, but pairwise integrations leave a gap: no tri-axial analysis treats Foucauldian governmentality, Marxian metabolic-rift analysis, and Beckian risk society as jointly productive of one decomposable phenomenon. This paper develops displacement of harm by synthesising analytic, demonstrated through a case study of battery electric vehicles (EVs). EVs deliver approximately 63 per cent lower lifetime greenhouse-gas emissions in Europe while concentrating costs in lithium, cobalt, and nickel territories outside conventional accounting. The principal contribution is triple coincidence: spatial, temporal, and social displacement covary because jointly produced by a single institutional architecture, so strategies performing best on conventional metrics displace cost most extensively along unmeasured axes. The framework offers an evaluative analytic for just-transition policy.

Keywords: *Ecological Crisis, Green Capitalism, Environmental Governance, Metabolic rift, Risk Redistribution*

*Received 06 July., 2026; **R**evised 15 July, 2026; **A**ccepted 17 July, 2026 © The author(s) 2026. **P**ublished with open access at **www.questjournals.org***

1. Introduction

The defining political claim of contemporary environmental governance is that the ecological crisis can be resolved without rupture: through technological substitution, market design, and reformed regulation within the existing global economic order. From the Paris Agreement to corporate net-zero pledges, from

[1] *Research Scholar, Faculty of Education, Banaras Hindu University, Varanasi, India.*
[2] *Research Scholar, Faculty of Education, Banaras Hindu University, Varanasi, India.*
[3] *Research Scholar, Faculty of Education, Banaras Hindu University, Varanasi, India.*
[4] *Professor, Faculty of Education, Banaras Hindu University, Varanasi, India.*
Corresponding Author – Himanshu Kumar Pandey (himanshu141995@bhu.ac.in)

the European Green Deal to electric-mobility subsidies, sustainability is offered as a managerial competence rather than a problem of structural transformation. This has produced demonstrable achievements: renewable electricity capacity has expanded faster than forecast (IEA, 2024); the carbon intensity of major economies is in long-run decline (IPCC, 2022); EV per-kilometre lifecycle emissions are substantially below comparable internal combustion vehicles. These gains are not incidental.

This paper contests a different claim: that aggregate gains amount to the resolution of harm. The inference treats environmental harm as an additive quantity reducible to a single number. The empirical record suggests otherwise. Demand for transition metals has restructured the political ecologies of the Lithium Triangle (Bustos-Gallardo et al., 2021), the Congolese Copperbelt (Sovacool, 2019), and Indonesian nickel territories (Lèbre et al., 2020). Carbon offset markets systematically overstate sequestration (Lohmann, 2009); REDD+ programmes concentrate dispossession in pastoral, forest, and customary-tenure communities (Beymer-Farris & Bassett, 2012; Fairhead, Leach & Scoones, 2012). The electrification of mobility relocates pollution from urban tailpipes to extractive geographies, refining hubs, and waste streams whose operational tempo is decoupled from consumer benefit. This does not contradict the desirability of decarbonisation; it undermines the claim that current strategies eliminate harm rather than reorganise it.

The thesis of this paper is that contemporary sustainability strategies within global capitalism do not resolve the ecological crisis but reorganise environmental harm through governance mechanisms, market structures, and technological systems. Three theoretical resources illuminate this reorganisation. Foucault's work on governmentality and biopolitics clarifies how sustainability operates as a productive form of power that constitutes objects of governance and shapes conduct through indicators, audit, and target-setting. Marx's analysis of capital accumulation and the metabolic rift (Foster, 1999; Foster, Clark & York, 2010) clarifies how the apparent dematerialisation of advanced economies depends upon the materialisation of low-carbon supply chains in extractive peripheries. Beck's account of the risk society (Beck, 1992, 2009) clarifies how late-modern environmental risks are systematically redistributed across geography, time, and social class.

The paper's contribution is an integrated framework — *the displacement of harm* — that synthesises the three lines into a single analytic decomposing reorganisation along spatial, temporal, and social axes. Pairwise integrations exist; what the tri-axial integration uniquely enables is the identification of *covariance* between the three axes, named here *triple coincidence*. The framework is operationalised

through a case study of electric vehicles, with a second application to voluntary carbon offset markets in Section 10.3. Section 2 reviews the literatures and specifies the gap. Section 3 develops the framework. Section 4 sets out methodology. Sections 5–7 analyse sustainability as governmentality, the political economy of green capitalism, and the limits of technological substitution. Section 8 presents the EV case. Section 9 articulates the framework, including its decolonial correctives. Section 10 concludes.

2. Literature review

The contemporary literature on sustainability and capitalism is organised around four positions, supplemented by parallel literatures on governance and risk. The Brundtland formulation institutionalised a framework in which environment, economy, and equity are balanced through technical adjustment (WCED, 1987; Sachs, 2015); its limitation is that constitutive trade-offs are managed rather than confronted (Banerjee, 2003). Ecological modernization theory (Mol, 2001; Mol & Spaargaren, 2000) illuminates the policy mixes producing declines in air pollutants and the carbon intensity of GDP across OECD economies; its limitation is methodological — it tends to bracket the ecological costs of those territories' supply chains, under-representing imported metabolic flows (Wiedmann et al., 2015).

A third body of literature examines green capitalism as a regime of accumulation organised through the climate policy infrastructure. Bumpus and Liverman (2008) characterised carbon markets as accumulation by decarbonization; Lohmann (2009) showed how carbon accounting transforms incommensurable practices into tradable units; Newell and Paterson (2010) traced climate capitalism as a coherent political project; Böhm, Misoczky and Moog (2012) argued that greening reproduces rather than supersedes the contradictions between accumulation and ecological reproduction. This work draws on metabolic-rift analysis (Foster, 1999; Foster, Clark & York, 2010; Moore, 2015). The degrowth literature (Kallis et al., 2018; Hickel, 2020; Hickel & Kallis, 2020; Parrique et al., 2019) argues absolute decoupling at the required rate is empirically unprecedented and theoretically implausible; its limitation is that the disaggregated analytic of *how* harm is reorganised within green growth remains under-developed.

A parallel governmentality literature (Hajer, 1995; Castree, 2008; Bakker, 2010; Heynen et al., 2007) analyses sustainability as governance — discourse as productive technology, with indicators, audits, and certification regimes as technologies of conduct (Rose, 1999); its limitation is development in relative isolation from political-economic critique. Beck's risk-society thesis (Beck, 1992, 2009) emphasises that wealth production in late modernity is shadowed by risk production, with risks migrating toward poorer

populations, later generations, and less politically organised geographies; the framework predates the consolidation of climate governance as an industry, and its application to contemporary instruments requires updating.

2.1 The gap addressed by this paper

Each literature frames a partial account: governmentality describes how sustainability operates as governance but not its relation to accumulation; political-economy critiques describe accumulation but not the granular distribution of harms; risk-society analysis describes redistribution but predates current sustainability infrastructure; degrowth specifies the macro problem but not the meso operation. *Pairwise* integrations exist: governmentality with political-economy in neoliberal-natures scholarship (Castree, 2008; Heynen et al., 2007); metabolic-rift extended to extractive geographies (Moore, 2015; Dunlap & Jakobsen, 2020); Beck linked to climate governance (Beck, 2009). The gap is the absence of a tri-axial synthesis treating governance, accumulation, and risk as jointly productive of a single decomposable phenomenon: the displacement of harm along spatial, temporal, and social axes.

What the tri-axial integration enables — and what pairwise treatments do not — is identification of *covariance* between the three axes. A governmentality reading identifies how lifecycle boundaries make manufacturing-stage emissions less visible than use-phase emissions; a metabolic-rift reading identifies the spatial concentration of extraction; a risk-society reading identifies class-stratified vulnerability. The integrated framework reveals these findings are not independent: the same accounting boundary that makes manufacturing emissions weakly visible at the level of indicator simultaneously makes their geography and the social distribution of their costs weakly visible. The three displacements are jointly produced by a single institutional architecture and are systematically correlated: strategies performing best on use-phase metrics displace cost most extensively on spatial and social axes. This covariance — Section 9.4's *triple coincidence* — is invisible to each register taken separately and is the framework's principal analytical contribution.

Two further integrative diagnoses warrant explicit engagement. Moore's (2015) world-ecology traces capital's accumulation imperative through the appropriation of cheap nature across geographies and historical longue durées, integrating accumulation with governance through socio-natural commodity frontiers. Dunlap and Jakobsen's (2020) violent technologies of extraction traverses accumulation, governance, and risk in a single movement, integrating extractive political economy with technologies of governance and the redistributed risks borne by frontline communities. Both approach tri-register

integration; neither, however, names the *covariance* of displacement across spatial, temporal, and social axes as a unified analytical object, nor specifies the institutional mechanism producing it. Moore's frontier is a structural metaphor whose tri-axial signature remains implicit; Dunlap and Jakobsen document violence across registers without theorising its covariance as the explanandum. The displacement-of-harm framework departs from each by isolating triple coincidence as a unified analytical object and by locating its institutional production in the architecture of sustainability accounting — a tractable target for evaluative critique that neither precedent specifies.

The closest precedent for the integrated diagnosis advanced here is Brand and Wissen's (2021) account of the imperial mode of living, which traces how the social and ecological costs of consumer lifestyles in the global North are systematically externalised across class, geography, and time. The framework presented here departs from theirs in one specific respect: where Brand and Wissen locate the integration at the level of consumption norms and the political compromises that stabilise them, the displacement-of-harm framework locates it at the level of the institutional architecture of sustainability accounting — the lifecycle boundaries, jurisdictional inventories, valuation conventions, and audit categories through which decarbonisation is rendered legible to policy. The covariance claim of triple coincidence is correspondingly more specific than that of the imperial mode of living: the three displacements are not merely co-occurring features of an externalising lifestyle but are jointly *produced* by a single accounting apparatus, with the analytical implication that they are jointly modifiable through changes to that apparatus. This shift from a sociology of consumption to an institutionalism of accounting distinguishes the present synthesis from prior integrative diagnoses, and it specifies a tractable target for evaluative critique that Brand and Wissen's more societal-systemic framing leaves indeterminate.

This gap is not merely scholastic. Operationally, sustainability policy is evaluated against indicators that are themselves the product of governance choices: lifecycle boundaries, accounting conventions, time horizons, jurisdictional scope. A framework that names what those choices systematically obscure — and the systematic *correlation* between what they obscure on the spatial, temporal, and social axes — is a precondition for more honest policy evaluation.

3. Theoretical framework

3.1 Foucault: governmentality and the conduct of conduct

The Foucauldian resource is the lectures on governmentality (Foucault, 2007, 2008), in which power is reconceived as a productive force operating through the shaping of conduct. Governmentality designates the rationalities and techniques by which populations are made governable: fields of intervention, indicators rendering those fields visible, and technologies — audit, certification, target-setting — through which conduct is calibrated. Sustainability discourse fits this register precisely. It produces objects (carbon budgets, ecosystem services, transition pathways), subjects (the responsible consumer, the green firm, the climate-vulnerable migrant), and procedures (lifecycle assessment, ESG disclosure, just-transition consultation). Governmentality is not repression: substantive environmental work is done within its frame. The question is what it forecloses, and how.

3.2 Marx: accumulation and the metabolic rift

The Marxian register supplies the structural analysis of why displacement is durable. Capital, for Marx (1976, 1981), is value in motion whose continuation depends on the appropriation of socio-ecological inputs and the disposal of wastes. Foster (1999) recovered the metabolic rift to designate the disjuncture between rhythms of capitalist production and ecological reproduction; Foster, Clark and York (2010) extended this to how the rift shifts across geographies. Moore (2015) reframed the question as cheap nature — the appropriation of unpaid socio-ecological work[5] — and Malm (2016) demonstrated, historically, that the choice of fossil fuels was the product of class struggle over the temporality and geography of production. The convergent claim is structural: capital cannot internalise its full ecological cost while remaining capital. Sustainability strategies operating within accumulation accordingly relocate, rather than eliminate, the externalities they target. The metabolic rift is not closed by green capitalism; it is geographically redistributed.

3.3 Beck: risk and the redistribution of harm

Beck's *Risk Society* (1992) supplies the third register. Beck argued that beyond a certain stage of industrial development, wealth production is shadowed by risk production, and risk distribution operates by a logic distinct from wealth distribution. Late-modern risks — radiation, persistent organic pollutants, cumulative

[5]Moore's (2015) cheap-nature formulation is contested in some readings; for an alternative emphasising the socio-natural specificity of energy regimes rather than a generalised cheapness, see Malm (2016).

climate change — are characterised by long latency, delocalisation, and invisibility to ordinary perception. Beck (2009) extended this globally, arguing climate risk renders methodological nationalism untenable. The framework foregrounds the temporal and cognitive properties of harm: many costs displaced by green capitalism are diffuse, slow, and difficult to attribute, migrating between places, classes, and calendrical horizons that exceed policy cycles and corporate accounting.

3.4 Integration: three registers, one analytic

The three registers are complementary lenses on a single phenomenon. Governmentality clarifies the *mode* of operation; Marxian analysis clarifies the *driver*; risk-society analysis clarifies the *form* of distribution. Together they ground the displacement-of-harm framework: governance produces the categories that make displacement unproblematic at the level of indicator (Foucault); accumulation produces pressure ensuring displacement is the dominant strategy (Marx); risk dynamics determine the geography and temporality of the resulting reorganisation (Beck). Each axis below — spatial, temporal, social — draws on all three. The integration is the analytical contribution.

Each register supplies its preferred mode of evidence — governmentality through discourse analysis, metabolic-rift through material-flow analysis of supply chains, risk-society through geographies of vulnerability. The framework treats these as complementary, with the displacement analytic as a translation device between them. A finding holding across all three registers is correspondingly more robust.

The framework does not reconcile the three theorists at the philosophical level. It uses each register *operationally* governmentality as method, the rift concept as structural account, risk redistribution as description of pattern integrating them at the level of the explanandum, not the foundation.

4. Methodology

The paper is a critical-conceptual study supplemented by a focused case. The principal contribution is theoretical the development of the displacement-of-harm framework and the case provides a discipline of concreteness. The approach is well-established for theory-building in environmental humanities and political ecology (Hajer, 1995; Castree, 2008).

The approach has three components. First, *discourse analysis*: a critical reading of IPCC and IEA reports, EU and national green-policy documents, corporate disclosures, and secondary literature, focusing on how

problems are framed, which categories are made central, and which costs are located outside the frame. Second, *secondary empirical analysis* of supply-chain political ecology, including LCAs and case research (Lèbre et al., 2020; Sovacool, 2019; Dunlap, 2018). Third, *theoretical synthesis* integrating the three registers. No primary data was collected; no ethics approval was required.

A reflexivity note is in order. The framework's principal theoretical inheritance is European critical theory: Foucault, Marx, Beck, and the Anglophone scholarship developed in dialogue with them. This inheritance equips the framework to analyse the institutional architectures of sustainability accounting and the structural drivers of accumulation, but it has corresponding limitations. It tends to treat displacement as a feature of an abstracted capitalist modernity rather than as a continuation of historically specific colonial and racialised geographies of extraction; it underweights the place-based ecological knowledge held by communities at the supply-chain peripheries; and its categorical apparatus — core, periphery, externality, frontier — is itself a product of the colonial epistemic order it is deployed to critique. Section 9 addresses these limitations not by appending an indigenous-and-decolonial corrective but by threading their corrections into the axis definitions themselves: Section 9.2 reframes the temporal axis as bidirectional in light of Whyte's (2020) account of cumulative colonial environmental change, and Section 9.5 consolidates and extends the corrective work that the axis definitions have already begun.

The absence of primary fieldwork limits the granularity of empirical claims; the focus on a single principal case (EVs) with a briefer second illustration (offsets in §10.3) does not establish full cross-instrument generalisation; the paper produces conceptual clarity rather than detailed instrument design.

5. Sustainability as governmentality

5.1 The constitution of measurable objects and subjects

Climate governance is mediated by an apparatus of measurement: GHG inventories, carbon footprints, temperature targets, biodiversity indices, ecosystem-service valuations. Each is a productive technology in the Foucauldian sense — not recording an antecedent reality but rendering socio-ecological process governable by giving it a form policy can address. The choice of metric is consequential. Tonnes of CO_2-equivalent privilege gases over land use; territorial accounting privileges production over consumption; lifecycle assessment is bounded by methodological choices about scope, allocation, and time horizon.

None of these choices is neutral; each constitutes governance differently.[6] A worked example: consumption-based carbon accounting (Wiedmann et al., 2015) consistently revealed that wealthy importing economies were responsible for a substantially higher share of global emissions than territorial inventories suggested. The finding was technically robust and politically marginal; it did not displace territorial accounting from international policy. The reason is not that consumption-based accounting is wrong but that it implies a different distribution of responsibility, and the existing apparatus was constituted around the territorial frame.

Sustainability discourse produces a typology of subjects: the responsible consumer, the green firm, the vulnerable adaptation recipient. Each carries a repertoire of conduct mediated by the apparatus of measurement and disclosure (Rose, 1999). Global North subjects are constituted around choice and optimisation; Global South subjects around vulnerability and eligibility. The asymmetry is reproduced in international fora not by bad faith but because the categories are organised around it.

5.2 Audit and the technologies of conduct

The proliferation of audit and disclosure regimes — ESG ratings, sustainability reporting frameworks, certification schemes for sustainable palm oil, green sovereign bonds — operates as a technology of conduct: behaviour is shaped by the production of comparable, monitorable performance scores. These instruments have substantive effects, sometimes desirable. They also exhibit a characteristic governmentality property: they make some forms of harm legible and others systematically illegible. What governance can see depends on what it has chosen to measure. When audit captures Scope 1 and 2 emissions but treats Scope 3 as voluntary, large categories of harm fall outside the score. When biodiversity offsetting valorises restoration in one place against destruction in another, the units of comparison are constituted by the methodology rather than discovered by it. The governmentality reading is not that sustainability indicators are arbitrary; they reflect, often well, important aspects of socio-ecological process. The claim is that they reflect those aspects through choices that have political content, and that the same apparatus producing substantive outcomes — air-quality regulation, ozone protection, emission-intensity targets — also produces, through its categorisations, the conditions under which displacement registers as success. The Foucauldian register thus identifies *how* displacement becomes

[6]The territorial / consumption-based accounting distinction is a methodological choice, not a controversy at the level of physical accounting. See Wiedmann et al. (2015) for the production-trade-consumption decomposition.

invisible at the level of governance: through the constitution of categories that bound the field of view. The political-economic register identifies *why* the categories are bounded that way.

Read on its own, the governmentality register describes how categories of measurement bound the field of view but cannot explain *why* lifecycle assessment, territorial inventories, and ESG disclosure are bounded the way they are. Section 6 supplies the structural answer: the boundaries reflect the institutional architectures of capital under sustainability constraint. Nor can governmentality alone characterise the resulting distribution — who bears, on what timeline, with what exposure to invisibility. The Beckian register developed in Section 7 supplies that. The three registers are integrative rather than competitive.

6. The political economy of green capitalism

6.1 Accumulation, the rift, and uneven geographic development

Displacement is not the product of poor measurement. It is the path of least resistance for a mode of production whose reproduction depends on the appropriation of socio-ecological inputs and disposal of wastes. Capital (Marx, 1976, 1981) treats the conditions of its own reproduction as exogenous. Foster's (1999) recovery of the metabolic rift demonstrated this in Marx's diagnosis of nineteenth-century soil exhaustion. What changes across capitalist eras is not whether reproduction is displaced but where *to*: decarbonisation in advanced economies depends on supply chains that materialise extraction, refining, manufacturing, and waste in other geographies. Accumulation has long been organised through uneven geographic development (Smith, 1984; Harvey, 2003). The IEA (2021, Chapter 1, Section 1.2, Figures 1.5–1.6) compares present concentration of refined production for transition minerals — top-three producer shares for cobalt, lithium, and rare earths approximately 75–90 per cent — analogically with petroleum supply during OPEC's leverage. Green industrial policy in core economies is structurally a demand-side intervention into a concentrated, contested supply geography historically organised by extractive capital.

6.2 Unpaid socio-ecological work and the financialisation of the transition

Moore (2015) foregrounds the role of unpaid socio-ecological work. Capitalism depends on cheap nature — cheap food, energy, labour, raw materials — with each frontier exhausted in turn. The transition-metals frontier — lithium under the Atacama, cobalt in the Congolese Copperbelt, nickel in Indonesian laterites — is the most recent, with a consistent triad of costs: water demands in arid territories (Bustos-Gallardo et al., 2021); occupational hazard and child labour in artisanal sectors (Sovacool, 2019, 2021);

deforestation and tailings in laterite operations (Lèbre et al., 2020). These are the predictable signature of accelerated demand meeting weak regulatory capacity and historically organised extractive territories. The financialisation of climate policy compounds this dynamic: green bonds, sustainability-linked loans, and the ESG universe channel capital using criteria financial markets can monitor — disclosed emissions, certifications, ratings (Christophers, 2022); material flows outside these categories are correspondingly under-valued. Bumpus and Liverman's (2008) accumulation by decarbonization describes the dynamic: climate-policy infrastructure becomes a site for new asset classes whose trajectory is shaped by financial valuation rather than ecological reproduction. The political-economic register identifies why governance categories bound the field of view as they do: the institutional architectures within which policy operates are organised around forms of legibility systematically excluding unmeasured costs.

The Marxian register, however, does not by itself specify the indicator-level mechanism through which displacement becomes politically tractable, nor the form of the resulting distribution. Structural pressure is necessary but not sufficient: the rift must also be rendered invisible at the level of measurement — the governmentality register supplies that — and its bearers must be identifiable as such, which the risk-redistribution register supplies. The three describe a single phenomenon at three levels of analysis.

7. Technological substitution and its limits

7.1 Substitution as displacement

A common rejoinder is that critical analysis understates technological progress: solar PV costs have fallen an order of magnitude in two decades; battery costs comparably. Empirical studies, however, find that alternative-energy expansion does not displace fossil consumption at scale. York (2012) showed that across countries, non-fossil electricity increases were associated with small reductions in fossil consumption. York and Bell (2019) generalised: historical transitions have, in aggregate, added more than substituted. Findings are subject to scale-related debate — whether national/global effects obtain at subnational scales — but the claim deployed here operates at the national and global scale where additionality evidence is strongest. Smil (2017) makes the point on longer scales. The mechanism is partly Jevons: efficiency gains lower unit costs and expand service scale. Net harm reduction is therefore conditional on demand-side dynamics. Adjacent technologies illustrate the same dynamic: integrated assessment models treat carbon dioxide removal as effectively unconstrained, permitting present emissions on the assumption of future removal (IPCC, 2022, Chapter 4) — temporal displacement.

7.2 Boundary effects and conditions for benign substitution

A second limit is methodological. LCAs typically draw boundaries around the use phase. Use-phase improvements (e.g., tailpipe elimination) register strongly while manufacturing-phase displacement registers weakly, especially when manufacturing concentrates in carbon-intensive grids. The result is a real but smaller net improvement than headlines suggest, with distribution geographically and socially specific (Figure 2). Conditions for benign substitution include: integration of consumption-based with production-based accounting; convergence of supply-chain and use-phase regulation; demand-management alongside supply-side substitution; explicit attention to the geographic and social distribution of manufacturing costs. None is technically inaccessible; their absence is a political-economy fact. The substitution debate is about the conditions under which technological gains are translated into harm reduction.

What this technical-political characterisation does not yet provide is an account of *whose* vulnerabilities the residual and reorganised harms heighten, and along what timelines. That characterisation requires the Beckian register: the additional and reorganised risks generated by partial substitution are not distributed in proportion to the benefits but migrate toward less politically organised geographies and longer-horizon victims. Without the risk-redistribution analysis, substitution scepticism remains a technical critique with indeterminate political content; with it, the technical limit becomes a distributional claim with traceable bearers — the precondition for the integrated analysis developed below.

8. Case study: electric vehicles and extractive supply chains

Electric vehicles are paradigmatic because they exhibit all three displacement axes simultaneously while delivering genuine aggregate climate benefits. Honest evaluation must hold gain and displacement in the same field of view.

8.1 The aggregate case for EVs

LCAs converge on a substantial net benefit for BEVs relative to comparable ICE vehicles, with magnitude depending on grid mix, battery chemistry, and lifetime mileage. Bieker (2021), comparing medium-segment 2021 European passenger cars, reports approximately 251 gCO_2e/km for gasoline ICE and 91 gCO_2e/km for the BEV on the projected average European grid — a 63 per cent reduction (Bieker, 2021, Figure 6). The IEA (2024, Chapter 4) reports a globally averaged figure closer to 50 per cent. Figure 2

adopts the Bieker (2021) values; the values are midpoint readings from the ranges Bieker reports under ICCT methodology, not exact figures.[7] Air-quality co-benefits in urban environments are additional and substantial.

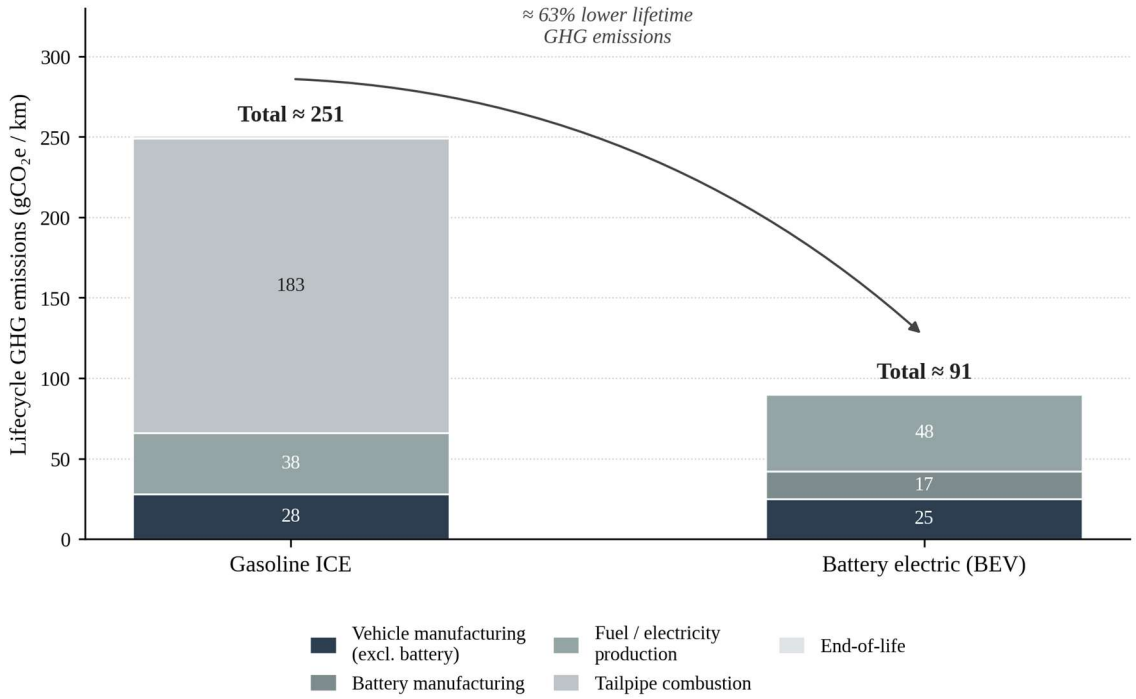

Figure 1. Lifecycle greenhouse-gas emissions of medium-segment European passenger cars (2021 registration), gasoline ICE vs battery electric vehicle, decomposed by stage (vehicle manufacturing, battery manufacturing, fuel or electricity production, tailpipe combustion, end-of-life). Values: ICE ≈ 251 gCO₂e/km; BEV ≈ 91 gCO₂e/km on the projected average European grid mix over a 240,000 km lifetime — a reduction of approximately 63 per cent. Source: Bieker (2021), ICCT White Paper, Figure 6. Note: this figure captures greenhouse-gas emissions only. Non-GHG costs — water depletion, biodiversity loss, and labour impacts in extraction territories — are structurally absent from lifecycle GHG assessment; their invisibility to this metric is precisely what the displacement-of-harm framework is designed to expose.

8.2 The supply chain and its concentration

The supply chain delivering this benefit is concentrated. Lithium is dominated by Australia (concentrate), Chile and Argentina (brine), and increasingly China; refining is concentrated in China. Cobalt is

[7]Bieker (2021, Figure 6) reports a lifecycle GHG of approximately 251 gCO_2e/km for medium-segment 2021 European gasoline ICE passenger cars, and approximately 91 gCO_2e/km for the comparable BEV running on the projected average European grid over a 240,000 km lifetime — a reduction of approximately 63 per cent. These point values, and the per-stage decomposition reproduced in Figure 2, should be read as approximate midpoint readings from the ranges Bieker (2021) reports under the ICCT methodology rather than as exact figures. The IEA (2024, Chapter 4) reports a globally averaged reduction closer to 50 per cent, varying primarily with grid carbon intensity.

dominated by the DRC, with significant artisanal contributions (Sovacool, 2019). Nickel has expanded rapidly in Indonesia and the Philippines via laterite operations (Lèbre et al., 2020). Cell manufacturing is concentrated in China, Korea, and Japan. The IEA (2021) documents top-three shares for refined cobalt, lithium, and rare earths of approximately 75–90 per cent — a concentration the IEA compares with petroleum during OPEC's leverage.

8.3 Spatial, temporal, and social displacement

The spatial axis is exhibited directly. Use-phase emissions are reduced in OECD cities; manufacturing emissions and non-GHG costs concentrate in extractive and processing geographies. Atacama lithium-brine extraction depresses aquifer levels in arid territories with indigenous land claims (Bustos-Gallardo et al., 2021). DRC cobalt is associated with occupational hazards, child labour, and limited revenue capture (Sovacool, 2019, 2021). Indonesian nickel laterite operations involve deforestation, marine sedimentation, and air-quality impacts from coal-fired processing (Lèbre et al., 2020). None is captured by use-phase metrics; non-GHG costs are systematically under-represented in standardised LCAs.

The temporal axis is exhibited in the disjuncture between the moment of climate benefit and the moment of certain costs. Battery-manufacturing emissions are produced in advance of vehicle use and offset depends on cumulative mileage achieved over the vehicle's life. Mine tailings and waste streams from extraction operations have governance and remediation horizons measured in decades; battery end-of-life infrastructure is, as of the mid-2020s, only partially operational at the scale required (IEA, 2024, Chapter 4). The temporal asymmetry is structural: the consumer benefit is immediate; significant cost components are deferred or distributed across decades. The social axis is exhibited in the distribution of beneficiaries and bearers. Beneficiaries of cleaner urban air, reduced fuel costs, and access to government EV subsidies are disproportionately middle- and upper-income households in OECD jurisdictions. Bearers of supply-chain costs are disproportionately mining-region populations, informal workers, and indigenous communities in resource-rich territories whose participation in the design of the transition is structurally limited (Bridge, 2009; Dunlap & Jakobsen, 2020).

8.4 What honest evaluation looks like

The EV case yields three observations. First, aggregate climate benefit is genuine. Second, that benefit coexists with structural reorganisation across all three axes. Third, conventional accounting makes the gain visible while making the displacement invisible. Honest evaluation requires extended environmental and social-impact assessment with water, biodiversity, and labour metrics treated as comparable terms;

attribution distinguishing gross reductions from net displacement; and distributional analysis as routine rather than specialist.

9. The displacement of harm: a framework

This section consolidates the framework. Displacement of harm names the reorganisation, rather than elimination, of socio-ecological costs through governance, market, and technological mechanisms. The operation is decomposed along three axes — spatial, temporal, social — each with characteristic mechanisms and analytical questions.

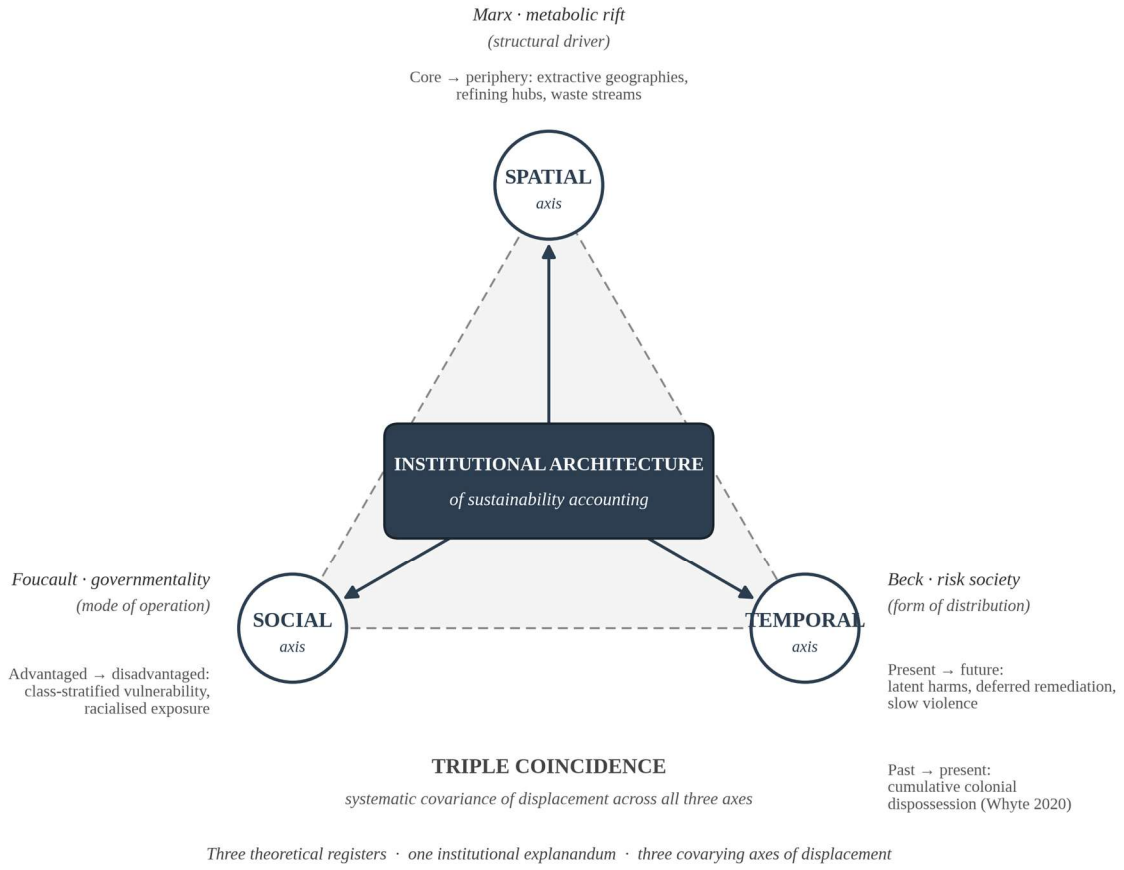

Figure 2. The displacement of harm: three axes of analytical decomposition. The framework integrates Foucauldian governmentality (mode of operation), Marxian metabolic-rift analysis (structural driver), and Beckian risk redistribution (form of distribution) along spatial, temporal, and social axes. The temporal axis is bidirectional: present-to-future deferral runs alongside past-to-present accumulation of colonial dispossession (Whyte, 2020), and it is this bidirectionality that distinguishes the framework's temporal axis from Beck's unidirectional risk-deferral account. Triple coincidence — the systematic covariance of displacement across all three axes — is produced by a single institutional architecture of sustainability accounting.

9.1 The spatial axis

The spatial axis describes the displacement of harm between geographies. Its principal mechanisms include supply-chain restructuring, in which the manufacturing and extraction stages of green goods are concentrated in jurisdictions whose regulatory and political-ecological conditions diverge from those of the consuming jurisdiction; carbon-accounting boundaries, where territorial inventories under-record the ecological footprints of import-dependent economies (Wiedmann et al., 2015); and offset trading, in which mitigation in one geography is debited against emissions in another (Lohmann, 2009; Bumpus & Liverman, 2008). The analytical question is straightforward: where, geographically, does the harm associated with this strategy occur, and how does that geography compare with the geography of benefit?

9.2 The temporal axis

The temporal axis describes displacement between calendrical horizons; it operates in two directions. Forward: displacement migrates through carbon dioxide removal assumptions in integrated-assessment models permitting present emissions against assumed future removals (IPCC, 2022, Chapter 4); long warming latency exceeding mitigation timeframes; durable waste streams whose remediation horizons exceed authorising institutions; and infrastructural lock-in, in which present transport, urban-form, and energy decisions constitute subsequent decades' demand profile. Backward: Whyte's (2020) account of indigenous climate justice characterises climate change as the continuation rather than initiation of cumulative colonial environmental transformation; for many indigenous and customarily land-tenured communities, climate vulnerability is the latest sediment in a layered history of colonial dispossession, not a future risk weighed against present strategies. What the framework tends to register as deferred future burden is, for some constituencies, sedimented past loss. The analytical question is bidirectional: when is the harm incurred — including time already elapsed — and how does that timing compare with the timing of benefit?

9.3 The social axis

The social axis describes displacement between social groups. Its mechanisms include class-stratified consumption of green-premium goods, where access to lower-emission consumption is mediated by income; the geographic-class compounding of this stratification with the spatial axis; intra-jurisdictional displacement, in which the costs of green infrastructure fall disproportionately on already marginalised communities (Brand & Wissen, 2021); and intergenerational redistribution, in which the costs of long-latency harms are borne by populations that did not authorise their production. The analytical question is

who benefits, who bears, and how the social distribution of benefit and cost relates to the existing distribution of socio-economic and political power.

9.4 Triple coincidence: the covariance argument

The three axes are analytically distinct but empirically entangled. The pattern observable in the EV case is *triple coincidence*: a strategy benefits a present, geographically core, advantaged constituency while displacing harms onto temporally distant, peripheral, disadvantaged constituencies. The coincidence is not coincidental: actors with greater political weight shape boundary conditions of the evaluation, so *winning* strategies are systematically those whose costs fall outside the field of view of winning constituencies. Each register taken alone identifies one direction of migration; only the integrated framework reveals these are jointly produced by a single institutional architecture of accounting boundaries, valuation regimes, and jurisdictional frames.

The mechanism connecting these three displacements to a single institutional architecture can be specified directly. Conventional sustainability accounting draws its boundary around the use phase within the consuming jurisdiction, and that single boundary performs three exclusions at once. First, manufacturing- and extraction-stage emissions sit outside the frame, rendering the geography of upstream costs invisible to the indicator — the spatial exclusion. Second, because the boundary is calibrated against current policy horizons (annual inventories, NDC cycles), longer-horizon remediation costs — tailings, water-table drawdown, end-of-life processing — fall beyond the political-cycle frame, performing the temporal exclusion. Third, the constituencies whose territories and bodies bear those costs do not appear in the indicator at all: they are absent from the consuming jurisdiction's audit categories, electoral cycle, and accounting standards — the social exclusion. The same boundary draws all three lines. The displacements covary because they are produced by a single institutional decision, jointly modifiable through changes to that decision.

9.5 Decolonial and indigenous correctives

The first corrective comes from indigenous environmental scholarship, exemplified by Coulthard's (2014) account of grounded normativity. What European theory describes as structural displacement is, on indigenous land, frequently the continuation of settler-colonial dispossession predating the climate-policy infrastructure, whose logic is not captured by metabolic-rift or risk-society vocabularies. Grounded normativity — the obligations and reciprocal relations between people and place constituting indigenous political life — is precisely what the spatial axis fails to register. The Atacama lithium brines and southern

DRC cobalt territories are not, on a Coulthardian reading, neutral *zones of extraction* into which transition demand is projected; they are inhabited landscapes whose disruption is a category of harm GHG and water-stress metrics cannot represent.

The second is decolonial scholarship, exemplified by Grosfoguel's (2011) analysis of the coloniality of power and its ecological dimensions. Grosfoguel situates the spatial axis within a longer history in which the constitution of *the South* as a zone of ecological appropriation predates and conditions the supply-chain politics of the present transition. The categories — core, periphery, externality, frontier — are themselves products of the colonial epistemic order they critique. These literatures sharpen the framework: they give historical depth to the spatial axis, which the rift concept flattens into a generic feature of capital; they specify that the social axis is racialised, not merely class-stratified, with bearer constituencies drawn from populations whose territories bore the costs of earlier extractive regimes; and they raise the question of whether bearer constituencies are also those whose place-based ecological knowledge could inform alternatives. These literatures are necessary complements to the framework, not optional supplements.

Whether the framework should continue to deploy categories whose colonial provenance has just been identified is a real question. Their continued use is defensible as a strategic deployment of dominant cartographies against themselves, following Grosfoguel's (2011) injunction that decolonial critique must engage the colonial-modern world-system rather than evade it, and Coulthard's (2014) endorsement of tactical engagement. The limitation is real: deployment risks reproducing what it deploys; the framework is to that extent partial.

9.6 What the framework is not

The framework is not anti-technology — it does not claim low-carbon technologies are net negative — but insists evaluation be honest about cost structure. It is not a denial of progress: substantive achievements (Montreal Protocol, lead phase-down, European electricity decarbonisation) cannot be reduced to displacement. It is not deterministic: different boundary conventions, valuation regimes, and participatory designs would produce different distributions. The framework is a diagnostic, not a fatalism.

9.7 Operationalisation

The framework is operationalisable through a heuristic checklist; its application to the EV case is given after each question. (1) What is the evidence of net aggregate benefit, and within what boundary? For EVs: ~63 per cent lower lifetime GHG emissions in Europe (Bieker, 2021), bounded by use phase,

territorial inventory, single GHG metric. (2) Where does the strategy reorganise harm across each axis? Spatially in lithium, cobalt, nickel territories; temporally in tailings, water-table, end-of-life liabilities deferred beyond the policy horizon; socially in bearer constituencies (Atacama indigenous communities, Congolese artisanal miners, Indonesian nickel-region populations) outside consuming-jurisdiction audit categories. (3) Relation between benefit and cost distributions? Inversely correlated — benefits to consuming-jurisdiction populations on present timelines, costs to extracting populations on deferred timelines: triple coincidence in operation. (4) Are answers reflected in formal evaluation? Only the first; others appear in scholarship but not in policy instruments calibrated against headline GHG metrics. The checklist produces structured information against which evaluative decisions should be made.

10. Conclusion: implications for theory and policy

Contemporary sustainability strategies do not eliminate the ecological crisis but reorganise its harms, decomposable along spatial, temporal, and social axes through the integration of governmentality, metabolic-rift, and risk-society registers. The EV case demonstrates the framework in operation; the principal contribution is *triple coincidence* — the systematic covariance of displacement across the three axes, jointly produced by a single institutional architecture. Each axis instantiates a Beckian mechanism — risks migrate toward less politically organised geographies, operate over horizons exceeding politics, and are class-stratified independently of wealth — but the framework adds to Beck a specification of mechanism: harm migration is a tractable consequence of governance categories, accumulation imperatives, and supply-chain configuration, all in principle modifiable.

10.1 Theoretical contributions

The principal theoretical contribution is the integrated framework itself: a synthesising vocabulary connecting governance, accumulation, and risk; an operationalisable decomposition into three axes; a checklist applicable to specific instruments. The framework is portable beyond EVs to other green-capitalism instruments — hydrogen, carbon dioxide removal, biofuels, agricultural offsetting — each exhibiting displacement dynamics the framework can systematise.

10.2 Policy implications

Several implications for policy follow. Each is analytically tractable but politically constrained, and each is at present only partially instantiated.

Evaluation criteria should widen to include consumption-based alongside territorial accounting; LCA integrating non-GHG metrics; distributional analysis as standard. The institutional obstacle is that territorial accounting underpins NDC calibration under the UNFCCC, giving net-importing economies structural reason to resist recalibration. Partial instantiation: the EU Corporate Sustainability Reporting Directive (double-materiality, value-chain disclosure) and the EU Carbon Border Adjustment Mechanism.

Green industrial policy should be linked to supply-chain governance, with binding mechanisms for environmental and social accountability in producing geographies. The obstacle: domestic industrial policy is increasingly justified on competitiveness and economic-security grounds, against which upstream accountability raises input costs and constrains strategic flexibility. Partial instantiation: the EU Battery Regulation (2023), the Corporate Sustainability Due Diligence Directive (2024), and the OECD Due Diligence Guidance.

Demand-side interventions — urban form, mode shift, sufficiency policy — should accompany supply-side substitution; the technological-only frame is itself a condition of displacement-invisibility. The obstacle is electoral: sufficiency lacks organised constituencies in growth-committed democracies; consumer-choice framings position demand-side intervention as paternalism. Partial instantiations include Japan's Top Runner programme and mode-shift targets in EU climate plans, but no jurisdiction treats sufficiency as a constitutive lever.

Just-transition programmes should be transnational rather than national; supply-chain cost bearers are located outside the jurisdictions capturing benefits. The obstacle is the methodological nationalism of climate finance and asymmetric donor-recipient framing, making binding cross-jurisdiction accountability politically expensive. Partial instantiation: the Just Energy Transition Partnerships (South Africa, Indonesia, Vietnam, Senegal from 2021) and the UNFCCC Loss and Damage Fund (COP28); both modest in scale but indicating the direction is institutionally tractable.

10.3 A second illustration and the limits of single-case demonstration

Voluntary carbon offset markets exhibit the same tri-axial signature in starker form. Spatially, offset accounting permits emissions in consuming geographies — corporate purchasers in OECD jurisdictions — to be debited against sequestration claims in producing geographies, predominantly forest- and land-use projects in the global South (Bumpus & Liverman, 2008; Lohmann, 2009). Temporally, present permission to emit depends on sequestration over decades, with permanence contingent on project

continuity and monitoring — asymmetry reinforced by integrated-assessment models treating negative-emissions flows as unconstrained (IPCC, 2022, Chapter 4). Socially, REDD+ and adjacent schemes concentrate dispossession on pastoral, forest, and customary-tenure communities whose tenure systems are imperfectly registered in property frameworks (Beymer-Farris & Bassett, 2012; Fairhead, Leach & Scoones, 2012). Triple coincidence operates through the offset architecture itself: additionality tests, baselines, boundaries, and permanence assumptions are jointly calibrated to render credits economically viable; tightening any along any axis would erode the credit volumes the architecture is designed to produce.

Limitations: the argument is at the level of framework, not detailed instrument design; the two cases demonstrate purchase across a technological-substitution and a market-mechanism instrument, but a fuller programme would test hydrogen, engineered CDR, biofuels, and agricultural offsetting; cross-axis displacement is not quantified — methodologies for this are an open programme; the engagement with indigenous and decolonial scholarship is a beginning, not a substitute for fuller treatment drawing on indigenous, decolonial, and Sinophone literatures on extraction and ecological knowledge.

10.4 Closing

This paper has not denied the achievements: renewable capacity has expanded faster than projected, the carbon intensity of major economies is in long-run decline, EV lifecycle emissions are substantially below comparable ICE alternatives. The argument is that aggregate progress coexists with structural reorganisation of harm, and the categories declaring progress are the same categories rendering reorganisation invisible. Celebrating the headline while dismissing the displacement is an artefact of what the accounting apparatus is configured to see.

The principal claim is that the three axes covary not as independent side-effects but because a single institutional decision produces all three. The accounting boundary drawn around use phase and consuming jurisdiction simultaneously excludes manufacturing emissions spatially, defers remediation temporally, and renders bearer constituencies absent socially. Triple coincidence is the name for this jointness — displacement as constitutive of how the present accounting architecture sees, and does not see, the world.

The four policy implications developed in Section 10.2 are not independent reforms but a single institutional reorientation: wider evaluation criteria including consumption-based accounting, binding industrial policy to upstream supply-chain accountability, demand-side intervention alongside

technological substitution, and transnational rather than national just-transition governance. Each meets the same political obstacle — the distributed interests that benefit from displaced costs remaining outside the categories through which policy sees.

None of this entails inevitability. The architecture is institutional, not physical: lifecycle boundaries can be redrawn, jurisdictional inventories supplemented by consumption-based metrics, distributional analysis made constitutive, bearer constituencies brought inside audit categories. The obstacle is political, and political obstacles can change. The framework is a diagnostic, not a verdict. The precondition for better governance is that displaced costs be made visible in the categories through which policy sees the world.

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